

11.0 HABITAT AREAS OF PARTICULAR CONCERN

11.1 NMFS Guidance

The interim final rule specifies that FMPs should identify habitat areas of particular concern within EFH. In determining whether a type, or area of EFH is a habitat area of particular concern, one or more of the following criteria must be met:

- (i) The importance of the ecological function provided by the habitat.
- (ii) The extent to which the habitat is sensitive to human-induced environmental degradation.
- (iii) Whether, and to what extent, development activities are, or will be, stressing the habitat type.
- (iv) The rarity of the habitat type.

Habitat areas of particular concern are referenced throughout the interim final rule and the technical manual. The intent of habitat areas of particular concern is to identify those areas that are known to be important to species which are in need of additional levels of protection from adverse effects. Management implications do result from their identification. Habitat areas of particular concern are intended to determine what areas within EFH should receive more of the Council's and NMFS' attention when providing comments on Federal and state actions, and in establishing higher standards to protect and/or restore such habitat. Certain activities should not be located in areas identified as habitat areas of particular concern due to the risk to the habitat. Habitats that are at greater risk to impacts, either individual or cumulative, including impacts from fishing, may be appropriate for this classification. Habitats that are limited in nature or those that provide critical refugia or could provide refugia (such as sanctuaries or reserves) may also be appropriate. General concurrences may be granted for activities within habitat areas of particular concern, however, greater scrutiny is necessary prior to approval of the general concurrence. Habitat areas of particular concern may also be more appropriate for enhancement, based on their importance to a species.

Identification of habitat areas of particular concern will be more critical in some regions than others. For some species/lifestages, limited information has been collected on species distribution or abundance. Life history requirements, however, may be understood and habitat needs may be known. In these cases, regions may use habitat areas of particular concern to focus their consultative efforts in key areas, even when species distribution surveys are not yet complete. These areas should be identified during the first round of EFH amendments as practicable. Due to limited time or information, however, other regions should continue to develop this information for later revisions. Habitat areas of particular concern should eventually be identified for all FMPs.

In determining habitat areas of particular concern, consideration should be given to the sensitivity, exposure, rarity and the importance of the ecological function of the habitat. An example is provided in Table 11.1.

Once a habitat type has been designated as EFH, the assessment of vulnerability and ecological importance should be conducted. This will assist in determining whether the area should be identified as a habitat areas of particular concern. The following matrix is offered as an example of how such a decision could be made.

**Table 11.1. Matrix for HAPC/ Vulnerability Assessment by Species:
Juvenile Spotted Sea Trout**

Essential Fish Habitat	Data Level	Sensitivity	Exposure	Rarity	Ecological Importance
Submerged aquatic vegetation	1	High	High	Medium	High
Emergent marsh grass	1	High	High	Low	High
Oyster reefs	1	High	High	Low	Medium
Mud and sand flats	1	Medium	Medium	Low	Low
Water quality	N/A	High	High	Low	Medium
Other	--	--	--	--	--

Vulnerable habitat can be defined as habitat that is susceptible to perturbation by natural or man-made events or activities. Further, vulnerability should be related to physical damage and removal and degradation of condition (quality). Physical damage and removal could be caused, for example, by anchors dragging through SAV. Degradation of quality could be caused by water quality conditions, for example, that impede reproductive success of submerged aquatic vegetation. Vulnerability must also be related to the functions or ecological value of a habitat for particular fishery species or life stage. Sensitivity is defined as the degree that a habitat feature is susceptible to being degraded by exposure to activities, events, or conditions. Exposure is defined as the probability that a habitat feature will be exposed to activities, events, or conditions that may adversely affect the habitat.

If sensitivity is rated as “high,” that habitat is highly sensitive to perturbation. A rating of “medium” means that the habitat is somewhat sensitive, and “low” means that there is little to no sensitivity to perturbation. Regarding exposure, “high” means that there is a high probability of the habitat feature being exposed to a perturbation, “medium” means there is a reasonable possibility of exposure, and “low” means there is little to no probability of exposure. Regarding rarity, “high” means the habitat feature is very rare, “medium” means that it is somewhat rare, and “low” means that it is common.

Note that the matrix does not account for current habitat quality. If only Level 1 data (presence/absence) have been used to identify the habitat as essential, another column could be added to characterize the habitat quality, if there are data to support such a characterization. Alternatively, such habitat quality data for species-specific habitat sites could be considered during the consultation process. Ecological importance represents the value of a habitat type to a species at a particular life stage, based on ecological function. SAV is important for shrimp as it provides shelter and food. Sand flats are less important, providing little shelter or food.

Other matrices may be developed to assess the vulnerability of habitat types to perturbations. The following is an example of an alternative matrix format (Table 11.2).

Table 11.2. Matrix for Vulnerability Assessment by Habitat Type: Submerged Aquatic Vegetation

Spotted Seatrout	Data Tier	Sensitivity	Exposure	Rarity	Ecological Importance
Eggs	1	High	High	Medium	Low
Larvae	1	High	High	Medium	Medium
Juveniles	1	High	High	Medium	High
Spawning	1	Medium	Medium	Medium	Medium
Adults	1	Medium	Medium	Medium	High
Other	--	--	--	--	--

Matrices such as the above examples could be used in the determination of habitat areas of particular concern. This would involve evaluating the ratings of vulnerability, considering the number or the weight of each determination (i.e., the number of “high” rankings or the importance of a particular “high” ranking). Using scientific judgment, certain areas or habitat types could be designated as habitat areas of particular concern.

The example matrices provided do not include an assessment of habitat vulnerability to natural phenomenon. Different habitats could be evaluated in relation to their vulnerability to natural perturbations, such as storms, earthquakes, or floods. Consideration should be given to how habitat vulnerability to natural phenomenon may interact with anthropogenic factors. Assessments such as these may be used in determining habitat areas of particular concern.

11.2 Complementary Criteria for the Identification of Essential Fish Habitat

Prepared by Jeffrey Short, Michael Murphy, and Charles O'Clair

The proposed rule for implementing the essential fish habitat (EFH) provisions of the Magnuson-Stevens Act includes criteria for EFH identification that emphasize species distributions, rather than habitats *per se*. The species considered are limited to those managed under a fisheries management plan (FMP), and EFH is determined separately for each species based on life-history habits. Five levels of increasingly precise EFH criteria are used to identify EFH, corresponding to increasing levels of knowledge regarding habitat use by FMP-managed species. The most restrictive criterion (Level 4) presumes knowledge of production rates of a species for each habitat type. Unfortunately, such detailed knowledge is unavailable for most target species.

At the other extreme, the least restrictive criteria (Level 0 and 1) correspond with the species general distribution. For Level 0, this is inferred from knowledge of habitat requirements and behavior, and the presumed distribution of habitats. Equally unfortunate, these criteria provide little information on the "essentiality" of habitats within the range of a species. The EFH criteria proposed here are an attempt to redress this deficiency of the Level-0 and Level-1 criteria, by placing more emphasis on habitat differences instead of species differences. The complementary criteria emphasize habitats that are used by multiple target species, and may be derived from the same information base necessary for Level-0 determinations. Use of the complementary EFH criteria is proposed when Level-0 information is all that is available, and an EFH determination that is more precise than the species distribution is desired.

We propose that habitats be classified hierarchically according to epibenthic depth, substrate type, energy level, etc. following Dethier's 1992 modification of the scheme initially presented by Cowardin et al. (1979). Although this approach excludes oceanographic features such as fronts that are clearly important fish habitats, it thereby places appropriate emphasis on habitat features that are vulnerable to long-term or irreversible damage from single human actions (such as physical burial from dredge and fill activities). Fronts and other oceanographic features, however, could be added to the classification system if necessary.

The complementary EFH criteria proposed here are explicitly constrained by practicality of implementation. These criteria will provide only a crude approximation of habitat priorities, but these priorities may be initially determined without additional field work, similar to the criteria of the proposed Rule. Results from future field work, however, may be readily incorporated into this habitat-based approach.

The complementary method is similar to the suggested method described in the Technical Guidance for identifying Habitat Areas of Particular Concern. The Technical Guidance should be consulted for further information on how to apply both methods.

Method for EFH Ranking

Step 1. Identification of Biogeographic Regions

The most important habitats for fish vary among the different marine biogeographic regions of the United States. For example, coral reefs are extremely productive and provide a complex of ecosystem functions for multiple FMP-managed species in the subtropical waters of the U. S., but are considerably less

important in subarctic waters. The habitats identified in the following step therefore depend on the biogeographic region where they occur.

Step 2. Habitat Classification

A habitat classification scheme provides a consistent framework for organizing habitat uses. The scheme presented by Dethier (1992) has several advantages, and is recommended as a default choice. This scheme is readily adaptable to different biogeographic regions and deep-water habitats, it emphasizes physical substrates, and variants are already used by other NOAA programs such as the CoastWatch Change Analysis Program (cf. Kiraly et al. 1991).

Step 3. Identification of Habitats Used by FMP-Managed Species

Within each biogeographic region, habitats used for reproduction, early life-stage rearing, cover, or foraging for all FMP-managed species are compiled as a column of a habitat-use table (*e.g.* column 1, table 1). These habitats may be determined from the life-history literature of each species. Habitat use for reproduction, early life-stage rearing, cover, or foraging by FMP-managed species provide additional columns of the table.

Step 4. Habitat Use Determination

Habitat use is indicated on the habitat-use table for each FMP-managed species. All habitats that are used by each life-stage of a species are indicated by an entry on the table for all use categories (reproduction, rearing, cover, foraging). A particular habitat may therefore have multiple entries for reproductive use by some species, for cover by others, etc.

Step 5. Habitat Use Ranking

The habitat use rank is the sum of all the entries across use categories. Thus, the highest-ranked habitats are those used by the most species for the most numerous functions (see Table 11.3). . Other considerations, such as species or habitat rarity, could also be added to the matrix for ranking habitat importance.

Prioritizing through Risk Assessment

Managers and regulators often need to prioritize projects for scheduling interagency consultations, establishing research priorities, and other activities to efficiently direct efforts where most urgently needed. The proposed system of ranking habitat importance according to FMP species utilization described above provides one criterion for ranking priority. Also relevant are criteria relating to the level of management concern developed through a risk assessment.

The risk of impacts to a particular type of habitat is determined by its sensitivity to disturbance and the current level (scale and periodicity) of ongoing disturbance. These factors can be combined to provide a measure of management risk for establishing priorities.

Environmental Sensitivity

The sensitivity of a given type of habitat to a disturbance regime depends on its ecological resistance (the

ability to resist change during a disturbance) and resilience (the ability to return to its pre-disturbance structure) (Connel and Sousa 1983). Factors that contribute to ecological resistance are 1) redundancy in function of component species, 2) tolerance to environmental fluctuations, 3) physical and chemical buffering capacity or flushing characteristics, and 4) proximity of the system to its ecological limits (Cairns and Dickson 1977). Resilience has four components: elasticity, amplitude, hysteresis, and malleability (Westman 1978). Elasticity is the time required for recovery, amplitude defines the level of disturbance that allows recovery, hysteresis describes the “path” of recovery, and malleability is a measure of the plasticity of the system (i.e., its capacity to persist in an altered state) (Cintron-Molero 1992).

Although quantitative data on resistance and resilience may be unavailable for many habitat types, enough information and experience should be available to array the habitats within a relative ranking system. For example, mangrove systems are thought to have great resistance and resilience to disturbance (Cintron-Molero 1992), whereas coral reefs tend to be sensitive and recover slowly (Maragos 1992).

For each habitat type, one could assign an “Environmental sensitivity index” (ESI), which would represent the relative resistance and resilience under a particular disturbance regime (natural or anthropogenic). For example, resistance and resilience of types of bottom habitat to trawling impacts could be rated on a scale of 1 to 3, and the ESI could be calculated simply as the mean of the two ranks (**Table 12.4**). In this scheme, various combinations of resistance and resilience produce an ESI ranging from 1 to 3. Habitat types with low resistance and resilience have high environmental sensitivity, and habitats with high resistance and resilience have low environmental sensitivity.

Current Level of Disturbance

Another consideration in assessing risk is the habitat’s current level of disturbance. For example, a higher risk is involved for a habitat type that has been impaired over a large percentage of its total area and is currently being disturbed at high annual rate than for a habitat that is mostly pristine and not being disturbed.

The current level of impairment or disturbance has two components: 1) the relative area of habitat that is impaired and 2) the ongoing rate of habitat disturbance. The relative area of impaired habitat is the estimated area of the particular habitat type that has been impaired by human activity divided by the total area of that habitat type in the biogeographic region. Ideally, this information would be taken from existing GIS maps. Where GIS data are not available, relative area disturbed could be estimated by professional judgement or proxy data, such as the proportion of coastline impaired versus the length of coast containing the particular habitat. The rate of habitat disturbance is the percentage of habitat disturbed each year (e.g., the percentage of total area of a habitat type that has been disturbed over the past decade divided by 10).

These two components--the percentage area impaired and the ongoing rate of disturbance--can be combined to give an index of the current level of habitat disturbance. For example, one could multiply the percentage area impaired times the percentage rate of disturbance, in which case, the “disturbance level score” would range from 0 (0% impaired, no ongoing disturbance) to 10,000 (100% impaired, 100% disturbed per year). For purpose of ranking habitats by priority, the disturbance level scores could be grouped (e.g., low, medium, and high) to provide an index with comparable weight to the index for environmental sensitivity (**Table 12.5**).

Management Priority Ranking

Finally, the habitat type's environmental sensitivity index, disturbance level index, and importance rank, could be combined and used as a guide for prioritizing research, interagency consultations, and other management activities. One could obtain a priority ranking by multiplying the indices and importance rank (as in last column in Table 11.3). This approach provides a means for focusing agency efforts toward the most important types of habitat that are also the most sensitive to environmental impacts and with the highest current level of ongoing disturbance.

Table 11.3. *Pro forma* example of a habitat-based approach to assessing and prioritizing Essential Fish Habitat. Habitat sub-types discriminated by dominant biota are omitted for simplicity.

Habitat Type	FMP Species Utilization				Risk Indices		Management Priority Index ^c
	(X ₁) Spawning (No.)	(X ₂) Early Life (No.)	(X ₃) Etc. (No.)	Habitat Rank (3X ₁)	Environmental Sensitivity Index ^a	Disturbance Level Index ^b	
2	10	10	10	30	3	1	90
3	10	10	10	30	1	3	90
4	10	10	10	30	1	1	30
Sublittoral Cobble	0	1	0	1	3	3	9
Sublittoral Gravel	1	0	0	1	3	1	3
Sublittoral Sand	0	0	1	1	1	1	1
etc.							

^a Calculated in Table 11.4 based on evaluation of the habitat type's resistance and resilience in the context of the prevailing disturbance regime.

^b Calculated in Table 11.5 based on percentage habitat area currently impaired and current rate of habitat disturbance.

^c Product of Habitat Rank and Risk Indices.

Table 11.4. Example of an approach for rating habitats for environmental sensitivity.

Habitat Type	Resistance	Resilience	Environmental Sensitivity Index ^a
1	3 = Low	3 = Low	3 = High
2	1 = High	1 = High	1 = Low
3	1 = High	3 = Low	2 = Intermediate
etc.			

^aMean of resistance and resilience scores.

Table 11.5. Example of an approach for rating habitats according to current level of disturbance.

Habitat Type	% Area Impaired	% Impaired per Year	Disturbance Level Index ^a
1	Low	Low	Low = 1
2	Low	High	Intermediate =2
3	High	Low	Intermediate =2
4	High	High	High = 3
etc.			

^a Combines second and third columns as a rank.

Literature Cited

- Cairns, J., Jr. and K. L. Dickson. 1977. Recovery of streams and spills of hazardous materials, pages 24-42 in J. Cairns, Jr., K. L. Dickson, and E. E. Herricks (eds.), *Recovery and restoration of damaged ecosystems*. University of Virginia Press, Charlottesville.
- Connel, J. H., and W. P. Sousa. 1983. On the evidence needed to judge ecological stability or persistence. *American Naturalist* 121:789-824.
- Cowardin, L. M., Carter, V., Golet, F. C. and LaRoe, E. T. 1979. *Classification of wetlands and deepwater habitats of the United States*. U. S. Fish and Wildlife Service, Office of Biological Services Publication USFWS/OBS-79/31. U. S. Government Printing Office, Washington D. C.
- Cintron-Molero, G. 1992. Restoring mangrove systems, pages 223-277 *In* G. W. Thayer (ed.), *Restoring the Nation's marine environment*. Maryland Sea Grant College Publication UM-SG-TS-92-06.
- Dethier, M. N. 1992. Classifying marine and estuarine natural communities: an alternative to the Cowardin system. *Natural Areas Journal* 12:90-100.
- Kiraly, S. J., Cross, F. A., and Buffington, J. D. 1991. The Federal effort to document trends in coastal habitat loss. NOAA Technical Memorandum CS/NOPPO 91-1.
- Maragos, J. E. 1992. Restoring coral reefs with emphasis on Pacific reefs, pages 141-221 *In* G. W. Thayer (ed.), *Restoring the Nation's marine environment*. Maryland Sea Grant College Publication UM-SG-TS-92-06.
- Westman, W. E. 1978. Measuring the inertia and resilience of ecosystems. *BioScience* 28:705-710.

11.3 Preliminary Application of the Complementary Criteria Approach to Identifying EFH for Bering Sea Groundfish

Prepared by Jeff Short, Adam Moles, and Mike Murphy

This is an initial attempt to apply the complementary criteria approach to identifying EFH for Bering Sea and Aleutian Islands groundfish. It is based on available data contained in the Preliminary Essential Fish Habitat Assessment Report for the Groundfish Resources of the Bering Sea/Aleutian Islands Region prepared by the Technical Team for Essential Fish Habitat for Groundfish in the Bering Sea and Aleutian Islands. For the purpose of this initial exercise, habitat types were taken as the broad categories used in the technical team's report because a habitat classification system for off-shore habitats has not yet been developed.

In the following table, utilization of the various habitat types is indicated for each major life stage of FMP-managed groundfish, based on descriptions in the technical team's Report. The sum of the number of life stages utilizing each habitat type provides a score which can indicate the relative importance of the various habitat types as EFH. This exercise is considered preliminary because of the lack of detail in the habitat classification and limited data on habitat utilization for many of the habitats and species.

Based on this preliminary analysis, the Complementary Criteria approach to assessing EFH shows promise in establishing the relative importance of various habitat types over a wide range of FMP-managed species and locales. Results suggest the importance of soft-sediment demersal habitat. Over 50% of the total scores in Table 11.6 were for species and life stages found in demersal habitat. Similarly, 83% of the scores among demersal species or life stages for which bottom type (Table 11.7) is known were from fine-grained sediments (some mixture of mud, sand, or granule). The Complementary Criteria approach may be most useful where habitat information is the most detailed, such as among nearshore habitats where information about bottom type, food, predators, current, temperature, and salinity can provide additional separation.

Further analysis including an estimate of the habitat type's environmental sensitivity and disturbance level could provide a guide for prioritizing EFH efforts. For example, soft-sediment demersal habitats rank high in species utilization and are probably also especially sensitive to disturbance, indicating they should be a high priority for research and other EFH efforts.

Discussion

For the purposes of habitat classification, Bering Sea groundfish can be conveniently divided into three categories: pelagic fishes living near the bottom of the continental shelf, demersal fishes, and fishes living in benthic sediments.

Offshore pelagic fishes such as walleye pollock, the larvae of most groundfish species, squid, sharks, eulachon and juveniles of both mackerel and rockfishes share a distribution defined more by the presence of currents, prey, and oceanographic features rather than bottom or shore type. If human activity other than fishing is likely to have any impact on these offshore, it would be in altering the prey field for these fishes. These fishes spend little time in close association with either the bottom or shore to be impacted by either pollution or habitat alteration. For these species, research needs to concentrate on the habitat requirements of their prey. If a significant amount of their prey require benthos or nearshore residence, human activity such as trawling, pollution, or dredging could reduce the food available to offshore species.

Demersal fishes, in contrast, often have specific habitat requirements. At present, most of our knowledge

of bottom type comes from grain size observations made during collections. Fish such as Pacific cod, sablefish juveniles, and capelin adults as well as squid seem to prefer fine grained sediments whereas mackerel adults prefer rocky bottoms. Cottids and octopi have been reported for nearly all types of bottoms. Whether rockfishes, skates, sleeper sharks and sablefishes have any distinct grain size preferences is unknown. These bottom types may be preferred because they harbor the preferred prey or may just reflect the bottom type suitable for trawling. Research should concentrate on sediment preferences among these fishes and impacts of trawling on those sediments.

Flatfishes, living in intimate contact with sediments, have specific and known preferences for fine grained sediments at all life stages. Juveniles rear in nearshore protected bays and estuaries on sediments sufficiently fine to enable burial. For flatfishes, the number of fish recruiting to the fishery is thought to be determined during the first 2 years of the juvenile stage, a time when the fish are putting on initial growth close to shore. The intertidal and subtidal zones are particularly susceptible to anthropogenic alterations, such as industrial runoff, pollution, construction, and marine debris.

The Dethier system for habitat classification was designed for nearshore habitats which can be conveniently inventoried by bottom type, currents, and tidal activity. Application of such fine tuning to offshore habitats may be impractical given the direct correlation between bottom type and trawling activity and lack of knowledge of other habitat parameters in the deep waters. In addition, some FMP-managed species complexes are either too ubiquitous (e.g., cottids) or we know too little about the life history (e.g., some sharks) for a classification system to work effectively on these species. For nearshore demersal species, however, the Dethier system has the potential for providing quantitative information about habitat utilization.

Table 11.6. Habitat utilization by major life stages of Bering Sea Groundfish.

Number of species/stages occurrence by habitat type.

Habitat Type	Life Stage					Total
	Eggs	Larvae	Juv.	Late Juv.	Adult	
Intertidal	2	1	-	-	2	5
Estuarine Subtidal	1	2	5	2	3	11
Inner Shelf Neustonic	-	2	1	-	-	3
Inner Shelf Pelagic	2	6	3	1	1	13
Inner Shelf Midwater	-	-	1	2	2	5
Inner Shelf Demersal	2	-	7	5	8	22
Middle Shelf Neustonic	-	2	1	-	-	3
Middle Shelf Pelagic	1	5	4	2	1	13
Middle Shelf Midwater	-	-	1	2	2	5
Middle Shelf Demersal	2	-	4	2	7	15
Outer Shelf Neustonic	-	1	1	-	-	2
Outer Shelf Pelagic	3	6	3	2	2	16
Outer Shelf Midwater	-	-	1	2	3	6
Outer Shelf Demersal	3	-	6	5	8	22
Upper Slope Neustonic	-	-	-	-	-	-
Upper Slope Pelagic	1	1	1	1	-	4
Upper Slope Midwater	-	-	-	-	-	-
Upper Slope Demersal	1	-	3	-	6	10
Lower Slope Neustonic	-	-	-	-	-	-
Lower Slope Pelagic	1	1	-	-	-	2
Lower Slope Shelf Midwater	-	-	-	-	-	-
Lower Slope Demersal	1	-	-	-	3	4
Basin Neustonic	-	1	-	-	-	1
Basin Pelagic	1	1	-	-	-	2

Basin Midwater	-	-	-	-	-	-
Basin Demersal	-	-	-	-	-	-

Table 11.7. Habitat utilization scores for Bering Sea groundfish.

Habitat Type	Eggs/Larvae	Juveniles	Adult	Score
Marine Intertidal				
Rock	-	-	-	-
Mixed Coarse	1	-	1	2
Gravel	-	-	-	-
Fines	2	2	2	6
Mud	-	-	-	-
Marine Subtidal				
Unknown	1	1	1	3
Rock	-	-	-	-
Mixed Coarse	-	-	-	-
Gravel	-	-	-	-
Fines	1	2	3	6
Mud	-	-	-	-
Estuarine Intertidal				
Unknown	-	-	-	-
Rock	1	-	1	2
Mixed Coarse	-	-	-	-
Gravel	-	-	-	-
Fines	2	2	2	6
Mud	-	-	-	-
Estuarine Subtidal				
Unknown	1	1	1	3
Rock	-	1	-	1
Mixed Coarse	-	-	-	-
Gravel	-	-	-	-
Fines	1	2	3	6

Table 11.7. Continued.

Habitat Type	Eggs/Larvae	Juveniles	Adult	Score
Inner Shelf Demersal				
Unknown	1	1	2	4
Rock	1	-	1	2
Mixed Coarse	1	-	-	1
Gravel	-	-	-	-
Fines	1	7	4	12
Mud	-	-	-	-
Middle Shelf Demersal				
Unknown	2	2	3	7
Rock	-	-	1	1
Mixed Coarse	-	-	1	1
Gravel	-	-	-	-
Fines	1	3	2	6
Mud	-	-	-	-
Outer Shelf Demersal				
Unknown	3	2	4	9
Rock	-	-	1	1
Mixed Coarse	-	-	1	1
Gravel	-	-	-	-
Fines	1	6	4	11
Mud	-	-	-	-
Upper Slope Demersal				
Unknown	1	2	4	7
Rock	-	-	-	-
Mixed Coarse	-	-	-	-
Gravel	-	-	-	-
Fines	1	2	2	5
Mud	-	-	-	-
Lower Slope Demersal				
Unknown	-	1	2	3
Rock	-	-	-	-
Mixed Coarse	-	-	-	-
Gravel	-	-	-	-
Fines	1	-	1	2

11.4 Habitat Areas of Particular Concern in Alaska

There are several habitat types in Alaska that meet all of the criteria specified in the interim final rule. These habitat types have important ecological functions, are sensitive and vulnerable to human impacts, and are relatively rare. A summary of these habitat types is provided below.

11.4.1 Living Substrates in Shallow Waters

Habitat areas of particular concern include nearshore areas of intertidal and submerged vegetation, rock, and other substrates. These areas provide food and rearing habitat for juvenile groundfish and spawning areas of some species (e.g., Atka mackerel, yellowfin sole), and may have a high potential to be affected by shore-based activities.

Shallow inshore areas (less than 50 m depth) are very important to king crab reproduction. After molting through four larval (zoea) stages, king crab larvae develop into glaucothoe which are young crabs that settle in the benthic environment in nearshore shallow areas with significant cover, particularly those with living substrates (macroalgae, tube building polychaete worms, kelp, mussels, and erect bryozoans). The area north and adjacent to the Alaska peninsula (Unimak Island to Port Moller) and the eastern portion of Bristol Bay are locations known to be particularly important for rearing juvenile king crab.

All nearshore marine and estuarine habitats used by Pacific salmon, such as eel grass beds, submerged aquatic vegetation, emergent vegetated wetlands, and certain intertidal zones, are sensitive to natural or human induced environmental degradation, especially in urban areas and in other areas adjacent to intensive human-induced developmental activities. Many of these areas are unique and rare. The coastal zone is under the most intense development pressure, and estuarine and intertidal areas are limited in comparison with the areal scope of other marine habitats for salmon.

Herring also require shallow water living substrates for reproduction. Spawning takes place near the shoreline between the high tide level and 11 meters. Herring deposit their eggs on vegetation, primarily rockweed (Fucus sp.) and eelgrass (Zostera sp.). These “seaweeds” are found along much of the Alaska coastline, but they often occur in discrete patches.

11.4.2 Living Substrates in Deep Waters

Habitat areas of particular concern include offshore areas with substrates of high-micro habitat diversity, which serve as cover for groundfish and other organisms. These can be areas with rich epifaunal communities (e.g., coral, anemones, bryozoans, etc.), or with large particle size (e.g., boulders, cobble). Complex habitat structures are considered most readily impacted by fishing activities (see previous sections of this document).

Corals are generally considered to be very slow growing organisms, and are a habitat of particular concern. Although scientists are not quite sure of coral's importance to fish habitat, it would certainly provide vertical structure for fish to use for protection and cover. Some observations to this claim have been provided by submersible observations. Coral habitat is likely very sensitive to human-induced environmental degradation from both fishing and non-fishing threats. It is not known how much coral there is off the coast of Alaska, but it is likely to be rare relative to other habitat types.

There are several species of deepwater coral found off Alaska. Two common species are red tree coral (Primnoa willeyi) and sea raspberry (Eunephthya sp.). Although these corals are thought to be distributed throughout the Gulf of Alaska and Aleutian Islands, much of the data analysis has focused on the eastern Gulf

of Alaska. NMFS trawl surveys have indicated high concentrations in the immediate vicinity of Dixon Entrance, Cape Ommaney, and Alsek Valley (Draft EA for Amendment 29 to the GOA Groundfish FMP, September 1992). In the GOA, NMFS surveys have taken red tree coral in very deep areas (125-210 fathoms), whereas sea raspberries have generally been taken in shallower areas (70-110 fathoms).

Information on coral distribution has been summarized in a 1981 report by R. Cimberg, T. Gerrodette, and K. Muzik titled, "Habitat Requirements and Expected Distribution of Alaska Coral." Though this report was written in the context of potential impacts of oil and gas exploration and development, information on habitat and distribution is relevant for our purposes. Though the report discusses coral distributions throughout Alaska, the focus here is on the information contained relevant to southeast Alaska.

The study notes that this Region probably has the largest number of coral species due to the variety of habitats in terms of depth, substrate, temperature, and currents. Primnoa, or red tree corals, are more abundant in southeast Alaska than in any other region. Other species of fan corals have been observed as well as bamboo corals, cup corals, soft corals, and hydrocorals. The greatest number of distributional records for red tree corals are from the Gulf of Alaska, in particular from the inside waters of southeast Alaska. In southeast Alaska, red tree corals have frequently been reported in Chatham Strait, Frederick Sound, and Behm Canal. The frequency of occurrences increases toward the ocean entrances and further away from the fjords. This trend is likely due to swifter currents near the entrances and/or greater turbidity and lower salinities in the fjords. Areas of highest densities are found in regions where currents are 3/4 knots.

Distributional records were additionally analyzed relative to the depths at which they occurred. Red tree corals have been reported at depths from 10 to 800 m. The lower depth limit varied in different regions of Alaska, increasing along a geographic gradient from the Aleutians to southeast Alaska. The lower depth limit of these corals in each area corresponds with a mean spring temperature of 3.7 degrees C. The report indicates that in southeast Alaska there is a difference in the lower depth limit exhibited north of 57°E latitude and that experienced south of that line (roughly running through Sitka). The data from the report indicate that, in the area of southeast Alaska north of 57°E, red tree corals are predominately found between 50 and 150 meters in depth. Significant occurrences continue to exist from 150 to 250 m, and taper off rapidly beyond 250 m. South of the 57°E line, they occur over a broader depth range with equal occurrences from 50 to 450 m. The report indicates that other species of sea fans may be found deeper than Primnoa, at depths up to 2,000 m.

Bamboo corals also occur in the waters of both the inside passages of southeast Alaska and in the southeast Gulf of Alaska. These corals have a lower temperature tolerance, about 3.0 degrees C, and exist in depths from 300-3,500 m. These corals are also expected to exist in a rocky, stable substrate and have a low tolerance for sediments.

The depth distribution of soft corals is, like the red tree corals, expected to range from 10-800 m, though they may exist on a much wider range of substrates. Hydrocorals, also occurring in southeast Alaska, have a depth range of 700-950 m, though they may occur at shallower depths in southeast Alaska than in the more northern, colder waters.

The report notes (again in the context of potential disturbance by oil and gas exploration and development) that recolonization of tropical coral communities requires at least several decades to recover from major perturbations. Alaskan corals would likely take much longer to recolonize following similar disturbances. For example, given a predicted growth rate of 1 cm/year for Primnoa, a colony 1 m high would require at least 100 years to return to the pre-impacted state. This, of course, is regardless of the origin of the impact.

11.4.3 Freshwater Areas Used by Anadromous Fish

Habitat Areas of Particular Concern also include all anadromous streams, lakes, and other freshwater areas used by Pacific salmon and other anadromous fish (such as smelt), especially in urban areas and in other areas adjacent to intensive human-induced developmental activities.